

CLAIMS

We claim:

1. A device comprising:
a cathode capable of catalytically reducing oxygen;
an anode capable of catalytically oxidizing hydrogen; and
an electrolyte in contact with both the cathode and the anode;
wherein the anode, the cathode, or both comprise a phosphate catalyst comprising
the formula:
$$M^1-M^2P_xO_y \cdot zH_2O$$

wherein M^1 is one or more platinum group metals or alloys thereof;
wherein M^2 is a transition metal;
wherein x and y are positive numbers; and
wherein z is a nonnegative number.
2. The device of claim 1, wherein the cathode comprises the phosphate catalyst.
3. The device of claim 1, wherein M^1 is platinum.
4. The device of claim 3, wherein phosphate catalyst comprises less than about 30%
platinum by weight.
5. The device of claim 1, wherein M^1 is palladium.
6. The device of claim 1, wherein M^1 is one or more platinum group alloys.
7. The device of claim 1, wherein M^2 is selected from the group consisting of iron, niobium,
tin, tungsten, molybdenum, antimony, tantalum, vanadium, zirconium, zinc,
titanium, chromium, cobalt, and combinations thereof.
8. The device of claim 1, wherein M^2 is iron.
9. The device of claim 1, wherein M^2 is niobium.
10. The device of claim 1,
wherein x is from about 1 to about 5;
wherein y is about 1 to about 20; and
wherein z is about 0 to about 2.
11. The device of claim 1, wherein the phosphate catalyst is doped with a transition metal.
12. The device of claim 11, wherein the phosphate catalyst is a p- or n-type conductor.
13. The device of claim 11, wherein the transition metal is molybdenum.
14. The device of claim 1, wherein the phosphate catalyst is combined with a conductive
support.

15. The device of claim 14, wherein the combination of the phosphate catalyst and the
conductive support comprises at least 20% by weight of the conductive support.
16. The device of claim 14, wherein the combination of the phosphate catalyst and the
conductive support comprises at least 50% by weight of the conductive support.
17. The device of claim 14, wherein the conductive support is carbon black.
18. The device of claim 14, wherein the conductive support is Vulcan carbon.
19. The device of claim 1, wherein the device is a fuel cell.
20. The device of claim 1, wherein the cathode and the anode are coated on opposing surfaces
of a proton-conducting membrane.
21. The device of claim 20, wherein the proton-conducting membrane comprises a
perfluorosulfonic acid polymer.